



Digging Deep on Growing Grains

VABF 2022

Farmer William Hale Buyer Ian Gamble Speaker Heather Coiner



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A Modular Curriculum for Growing Food Grain for the Local Market

Thank you to our funders and supporters:

- Southern SARE (Grant #LS20-327)
- Virginia Tech and Virginia Cooperative Extension
(Dr. Wade Thomason and Eric Bendfeldt)
- NRCS (Chris Lawrence)
- And Many Other Member and Partners!





Grain is a
staple food
of every
culture, yet
how many
Americans
know their
grain farmer?



A close-up, top-down view of a large pile of yellow and white corn kernels. The kernels are densely packed and show some signs of being processed, with some white husk or chaff still attached. A few small pieces of green and brown plant matter are scattered throughout. A semi-transparent grey horizontal bar is centered across the middle of the image, containing the text "We are learning together" in a white, sans-serif font.

We are learning together

What are our objectives today?

1. Who is everybody?
2. What is the local grain economy & who are the buyers?
3. What things apply to all grain crops?

10 min break around 3:30

4. What about some specific crops?

Corn, wheat, sorghum, oats



4 pm discussion

**Small
Groups
(30 min)**

1. Which crop is a good choice for my farm plan or existing operation?
2. What is the appropriate scale for me?
3. How much is it going to cost?
4. Something else?

**Full Group (20 min)
&
Evaluation**



Who are we?



Sources B. Ferguson



Who are you?





Pete Sisti, Greater Richmond Grains, Powhatan, VA



- Miller
- Maltster

- Restaurant
- Mill-Bakery
- Craft brewery
- Oat Milk brewery
- Tortilla maker

- Home cook
- Home miller / baker



Pete Sisti, Greater Richmond Grains, Powhatan, VA



{ Miller Maltster }

{ Restaurant }

Direct market

{ Home cook Home miller / baker }



Crop (lbs/Bu)	Commodity Price *USDA AMS for VA 1/11 ** <u>Bin-run</u>	Organic Commodity Price *USDA AMS for USA 12/15 ** <u>Bin-run</u>	CGA Processor VA Price *Organic and conventional ** <u>Cleaned</u>	CGA Processor MD Price *Organic ** <u>Bin-run</u>	Wholesale Price *DC Metro ** <u>Cleaned</u>	Retail Price *DC Metro Direct ** <u>Cleaned</u>
Wheat (60)	\$8.70	\$14.25	\$36-54 (\$60)	\$22.80	\$58.80-\$92.40	\$108-\$480
Corn (56)	\$6.51	\$9.75	\$28-\$84	\$32.50	\$84-\$100.80	\$100.80-\$280
Buckwheat (50)	n/a	n/a	\$26-\$34.40	\$26.00	\$110-\$180	\$200-\$350
Rye (56)	n/a	n/a	\$33.60-\$56	\$32.50	\$60.48-\$112	\$100.80-\$280

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Who are the CGA buyers?



WADE'S MILL

SEYLOU

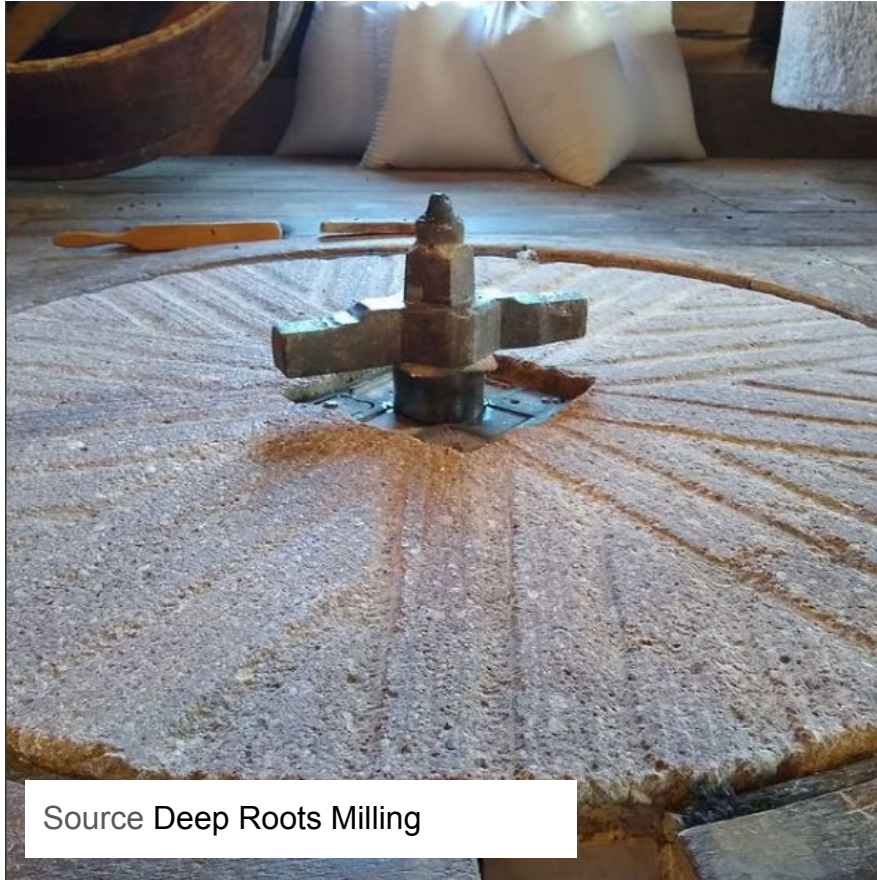
BAKERY & MILL



What do CGA buyers want?

Growing practices

- No glyphosate
- Minimize other sprays
- Minimize soluble Nitrogen
- Strong soil health practices





www.4thesoil.org

Source: A Cooper



Cover crop



Minimize tillage



Cover crop

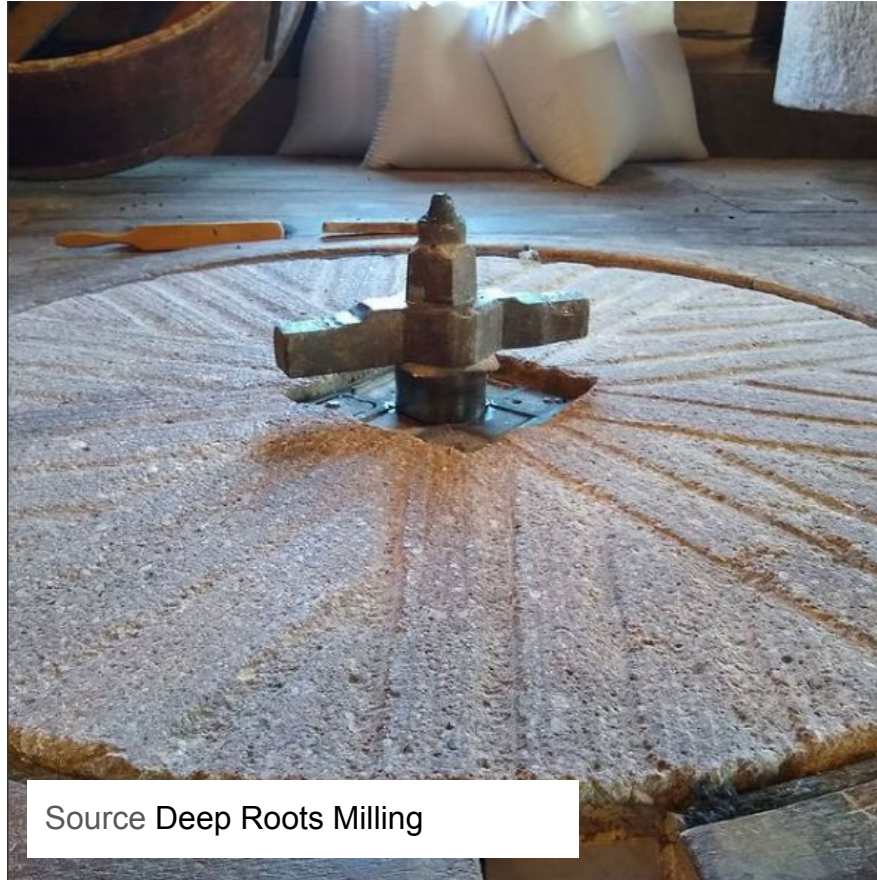


Vary crops & interseed

What do CGA buyers want?

Growing practices

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- Minimize other sprays
- Minimize soluble Nitrogen
- Strong soil health practices



Grain quality

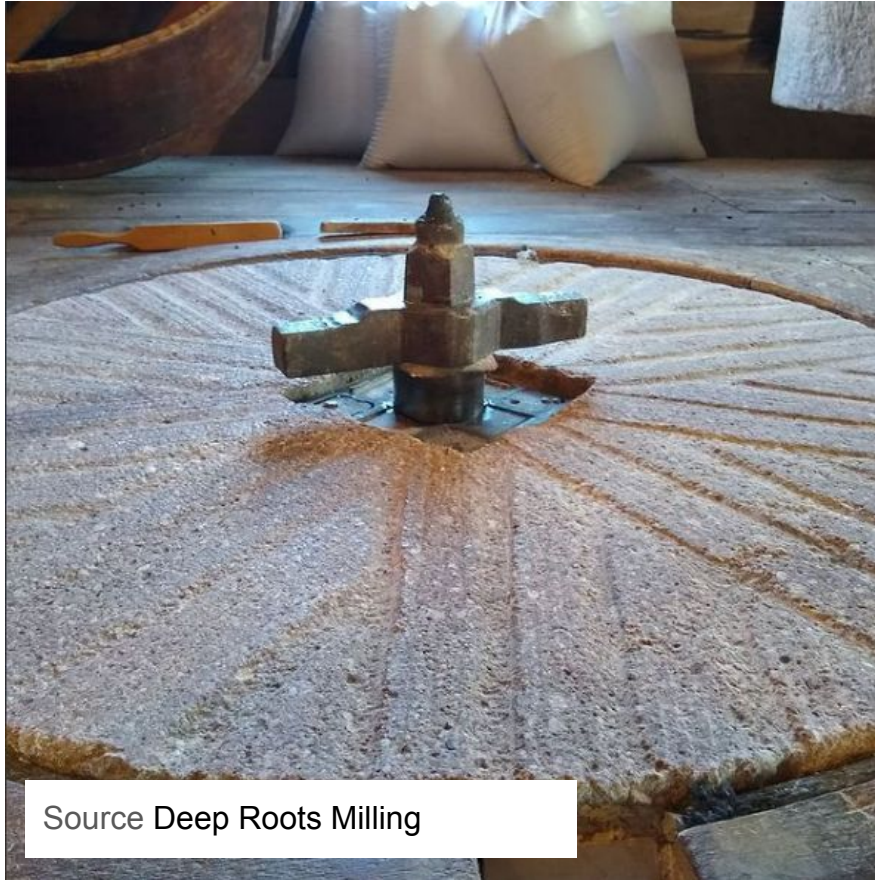
- No stones, dirt, weed seed
- Good test weight
- No insects
- No off odors
- DON < 1 ppm
- Adequate protein
- Adequate falling number
- Varieties with good flavor, milling qualities



What do CGA buyers want?

Growing practices

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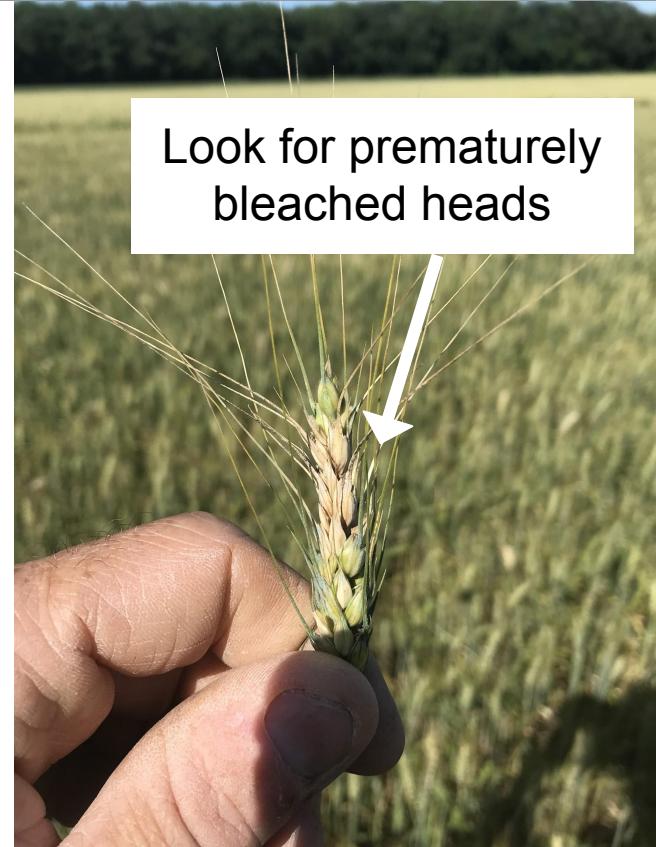




Fusarium Head Blight



- Caused by wet weather when flowering (lasts 7-10 d)
- Leads to DON >1 ppm (vomotoxin)
- Don't plant following corn or other grain
- Some varieties have resistance
- Can be cleaned out but lowers yield

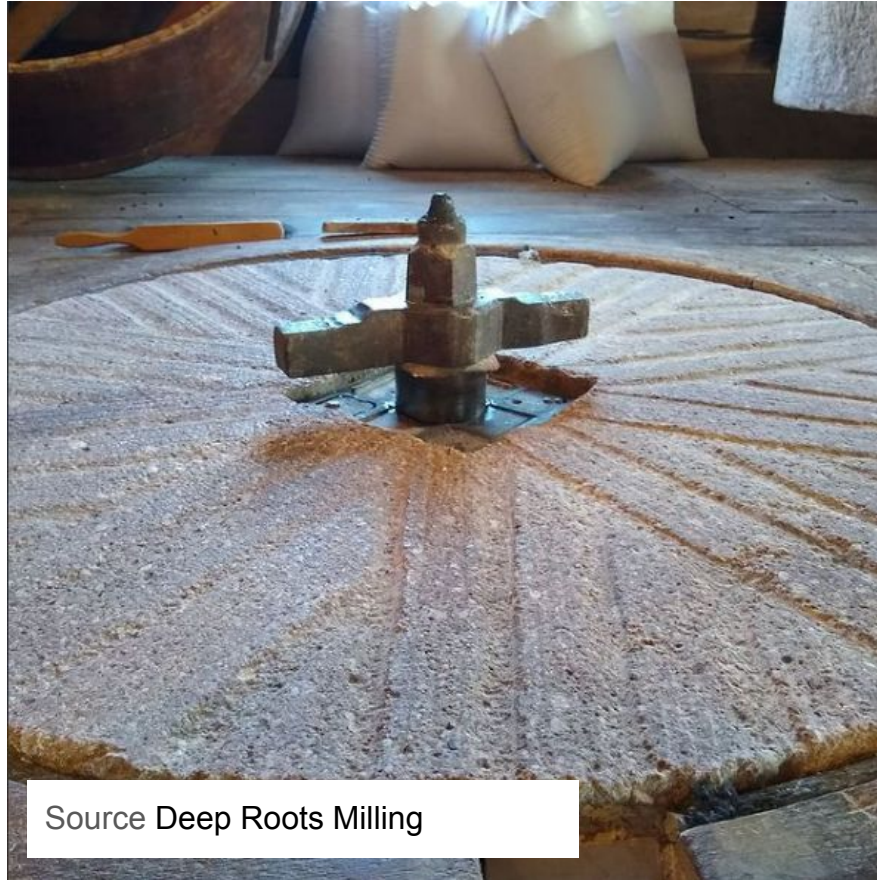


Sources agcrops.osu.edu, A. Cooper, Keller (2011)

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- Good test weight
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Wheat harvest timing: sprouting



- Wet conditions lead to sprouting
- Leads to low falling number
- Grow resistant varieties
- Can be cleaned out?
- Sprouted grain can be used as feed
- Watch the weather



Even if you don't see this, your grain may have sprouted



Barley

Falling number > 300

Brewers: Needs to sprout properly during malting



Wheatland Spring Brewery

Rye

Falling number 100 - 250?

Conventional bakers: lower
Artisanal bakers: higher
Distillers: ??



Motzi Bread Benne Rye Loaf

What if my grain doesn't meet the grade?

Sprouted

DON
too high

Protein / test
weight too low



Distillers
Your own farm
Your neighbors



How do I find CGA buyers?

Email: onawa@commongrainalliance.org



**ONAWA
DUFRESNE-
BARGER**



**JILLIAN
O'DONOHUE**



LIBBY LYON



**BENJAMIN
SHOROFSKY**



commongrainalliance.org



Weigh costs and benefits before going for a higher price

Aim high, but make a backup plan

Source CJ Isbell

Questions?



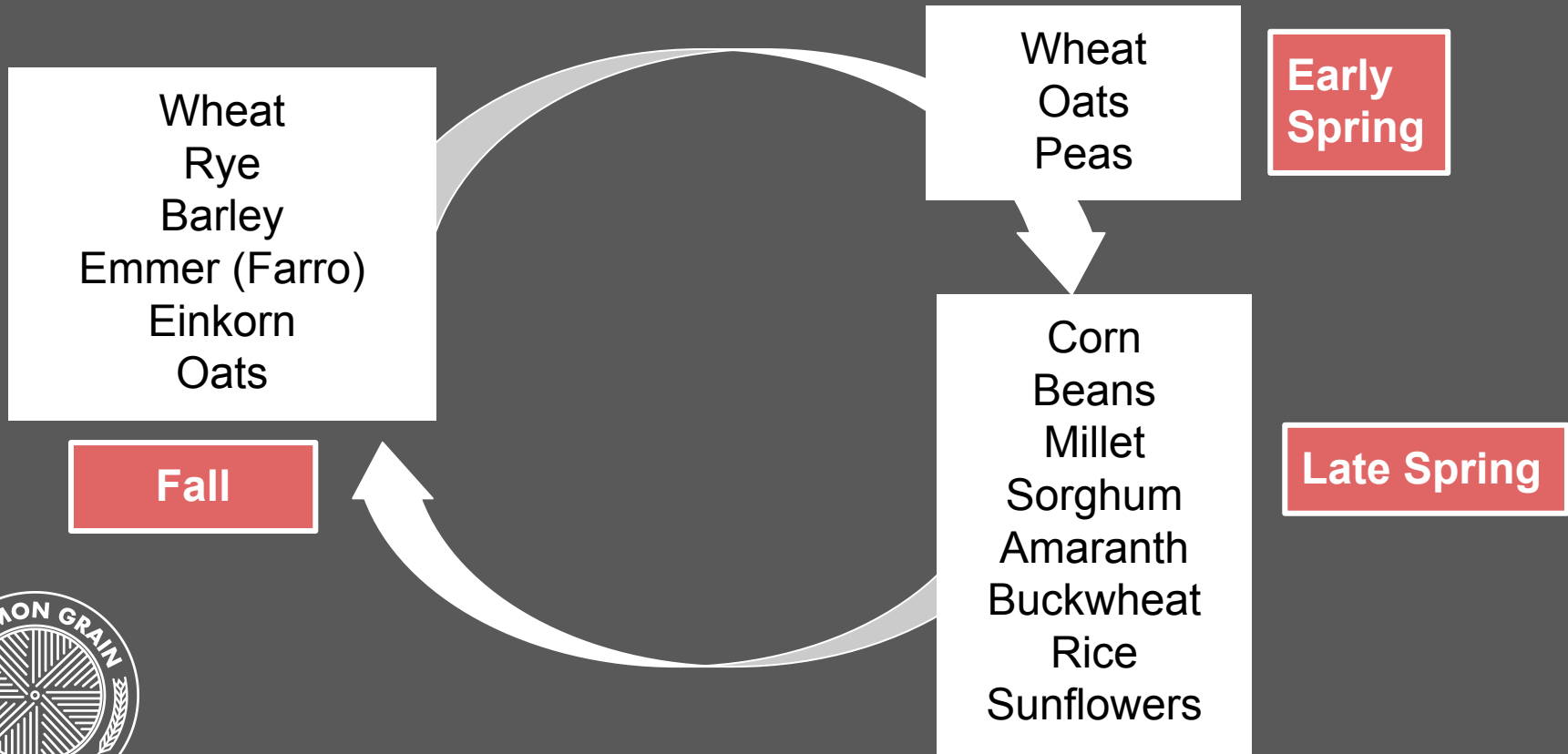
Source Deep Roots Milling



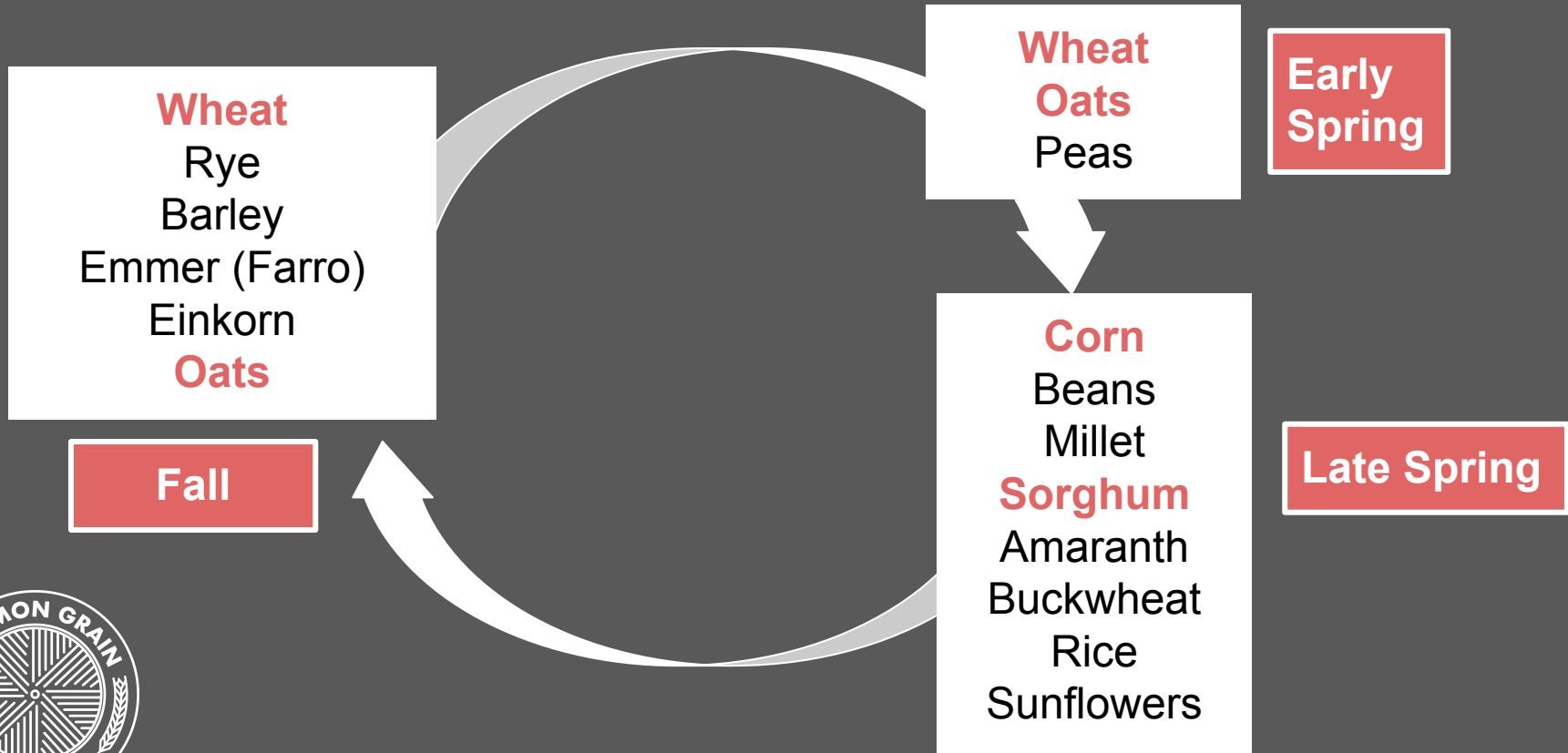
General Principles



What crops are we talking about?



What crops are we talking about?



Garden

Small

Mid

Large

	Garden	Small	Mid	Large
Plot size	< 1 acre	1-10 acres	11-100 acres	> 100 acres
Planting & Cultivating	Hand tools	Small tractor	Bigger tractor	Huge tractor
Harvesting	Hand tools, household supplies	Pull-behind implements or custom	Pull-behind or small combine or custom	Combine
Drying & Storage	Household supplies, grain bags	DIY dryers, grain bags	Batch dryer, bins, augers, grain bags	Same
Cleaning	Buckets, a fan, & a tarp	Custom or antique / small tools	On-farm or custom	Same
Marketing	Home use	Retail	Direct market & Processors	Processors

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Preparing the soil for planting

Garden



Everyone else

Primary



Secondary



Fitting



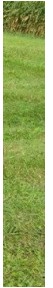
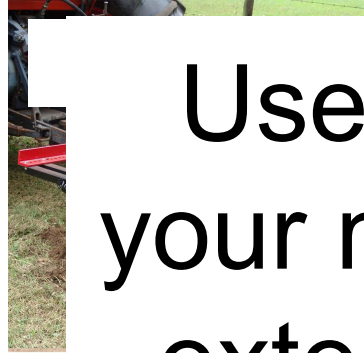
Preparing the soil for planting

Garden



Everyone else

Use what you,
your neighbors, &
extension have
on hand



Seeding your crop

Garden



Everyone else



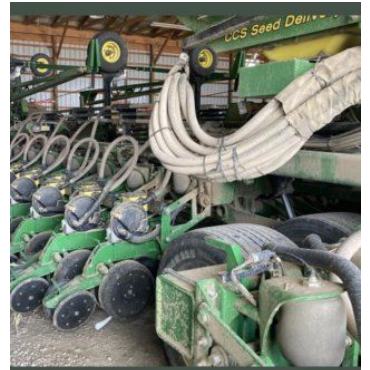
Seeding your crop

Garden



Match your
planting gear to
your cultivation
gear

se



Drying



Water content for safe storage



\$500-\$700

Grain	Recommended Moisture for Storage
Corn	13-15%
Soybeans	11-13%
Wheat	12.5-13.5%
Sorghum	11-12%
Oats	11-13%

Tip: warm your grain before measuring



Batch dryer

Air dried grain is generally better quality, but batch (propane) drying makes sense in the face of factors like:

- wet weather
- lack of time

PERC Propane Drying Calculator:
<https://propane.com/propane-products/grain-dryers/>



Source A. Cooper

DIY Mini batch dryer

- Fan taken from a storage bin
- Connected to a perforated drainage pipe
- Run pipe through grain in a bag or bin to air dry
- Easy and cheap for small- and mid-scale



Source A. Cooper



Storage

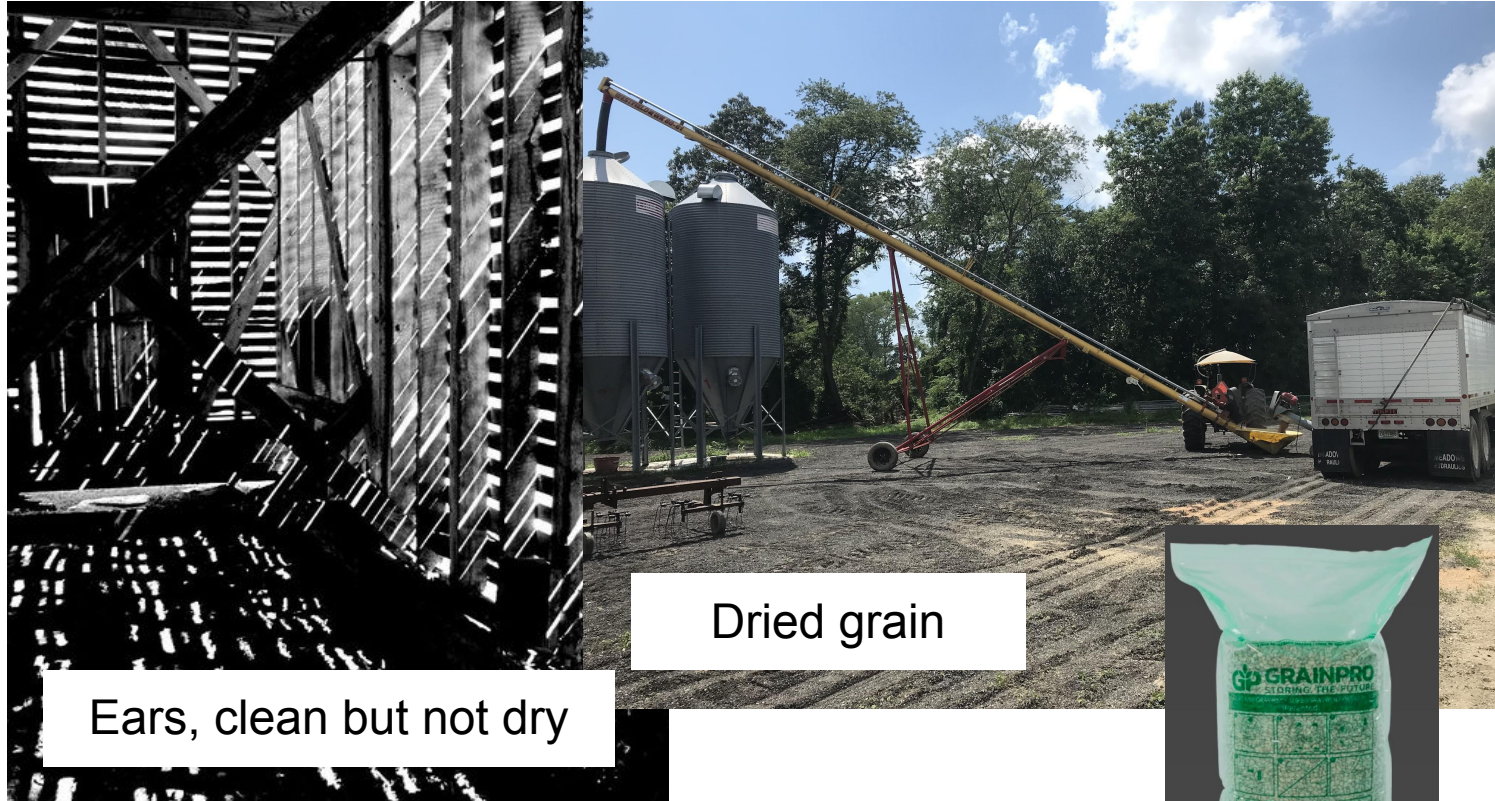
Types

Agronomy

Planting

Cultivation

Harvest



Ears, clean but not dry

Dried grain



Sources A. Cooper, Lazor 2013, "[Sunshower \(Corn Crib\)](#)" by [David Hoffman '41](#) is licensed under [CC BY-NC-SA 2.0](#)



Storage

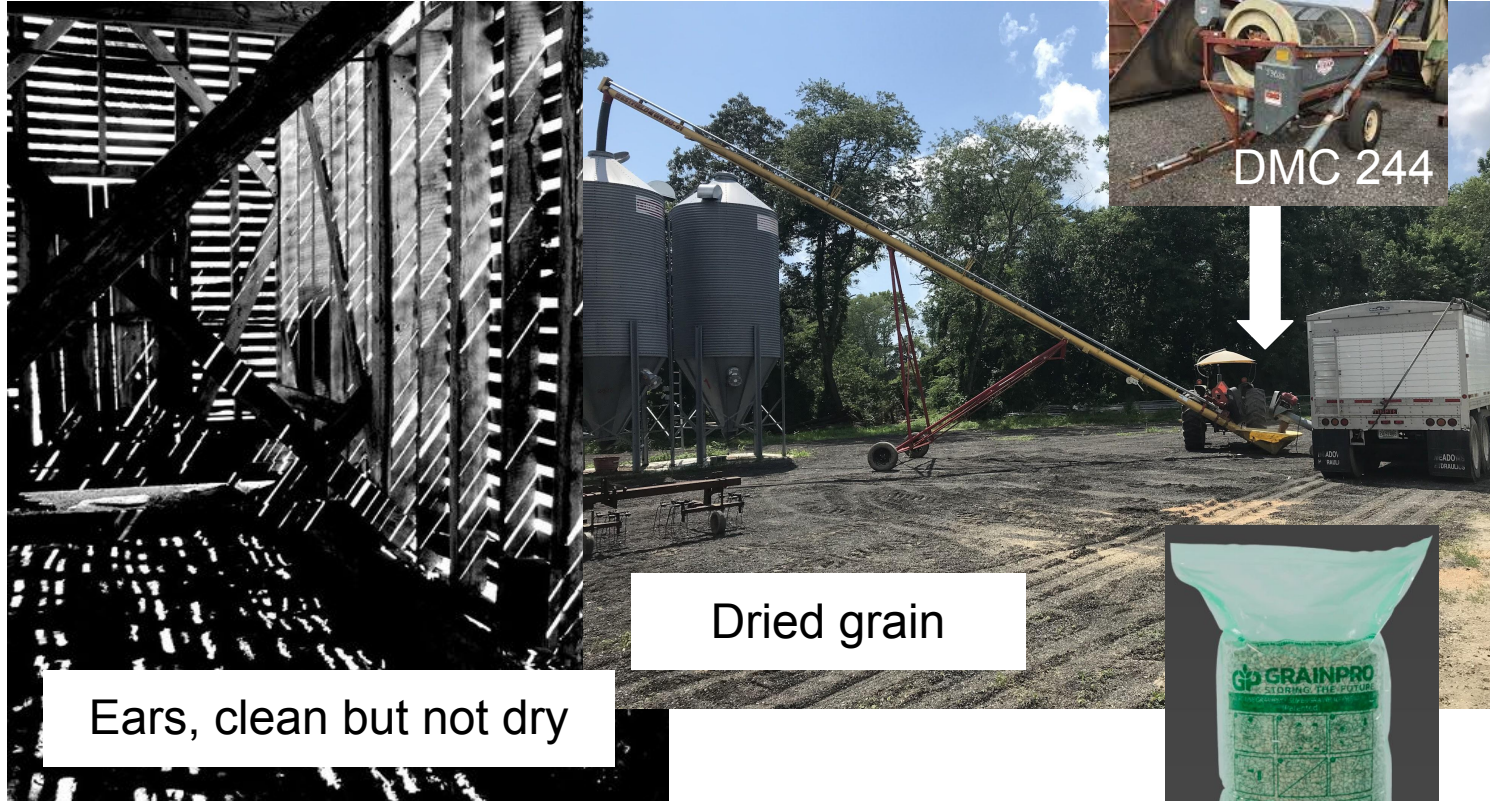
Types

Agronomy

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Cultivation

Harvest



Sources A. Cooper, Lazor 2013, "[Sunshower \(Corn Crib\)](#)" by [David Hoffman '41](#) is licensed under [CC BY-NC-SA 2.0](#)

Controlling pests using CO₂



Source A. Cooper, Grainpro.com

Organic post-harvest pest control
No need for cold storage

Transporting finished grain



>20,000 lbs

Source A. Cooper, Grainpro.com





The economics of 1-100 acres of grain are tricky, so use what you & your community have on hand

Do your best to air dry your grain, but don't be afraid to use propane to save your crop

Source CJ Isbell

A close-up, top-down view of a large pile of corn kernels. The kernels are a mix of yellow and white, with some showing signs of being broken or processed. A semi-transparent grey rectangular box is centered horizontally across the middle of the image, containing the text "Questions so far?".

Questions so far?

Breaktime!





Corn



Source Red Tail Grains





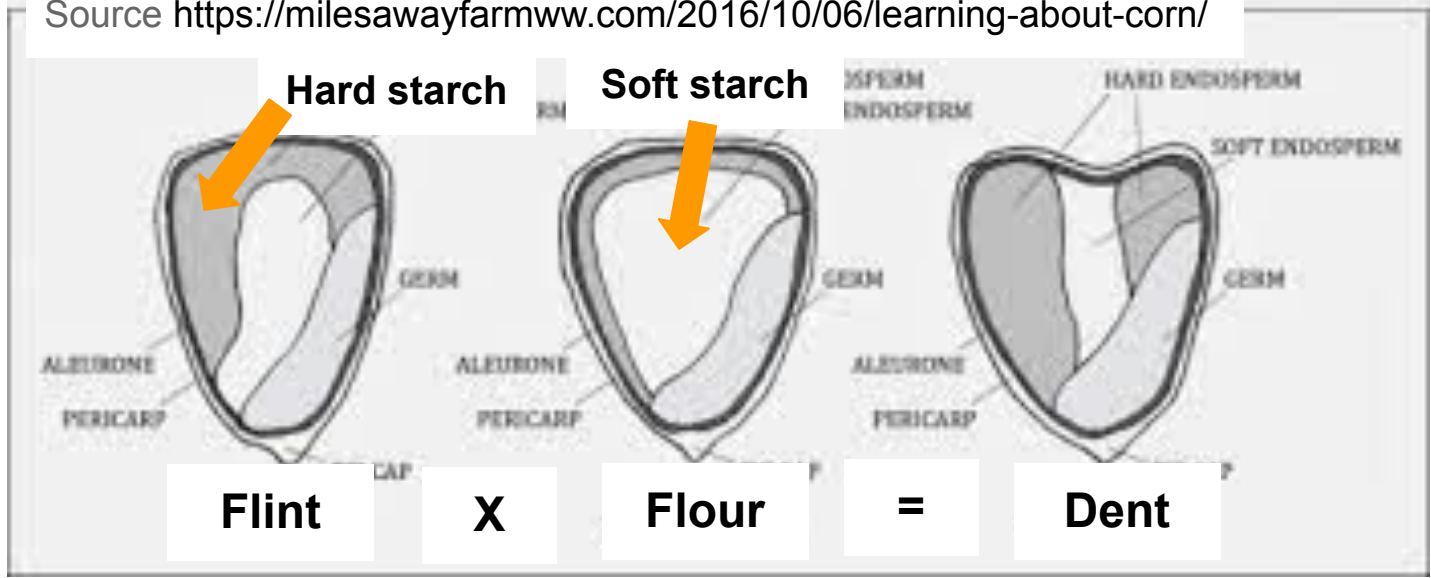
Types

Agronomy

Planting

Cultivation

Harvest





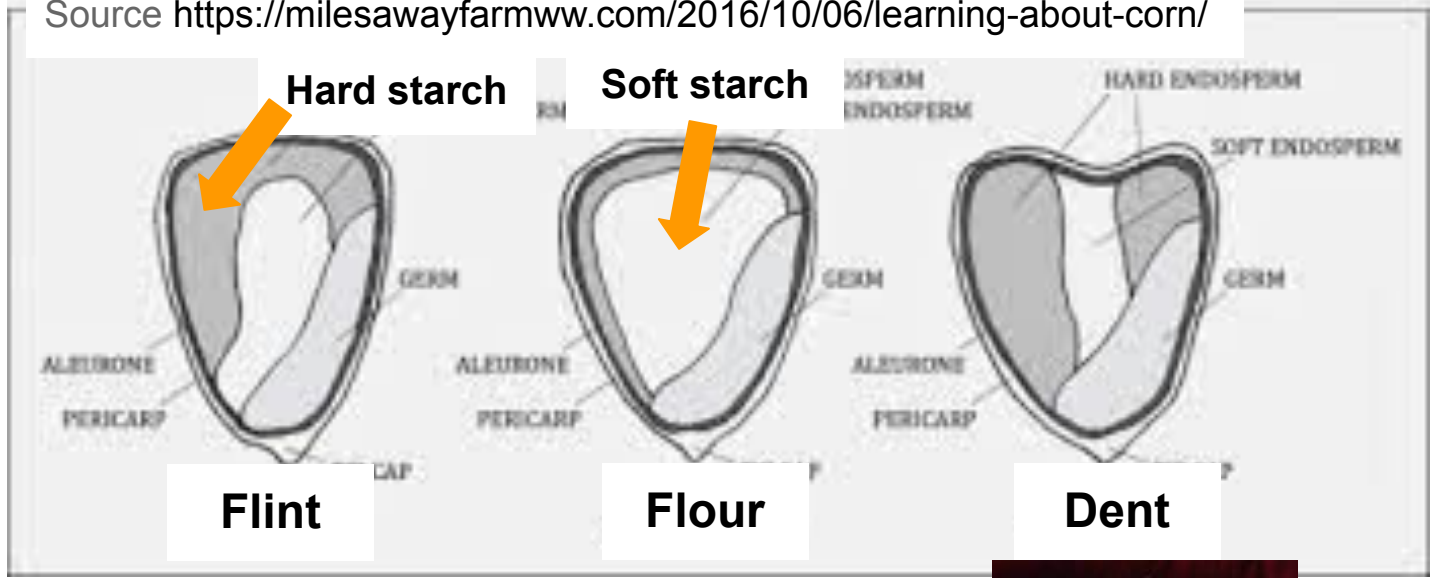
Types

Agronomy

Planting

Cultivation

Harvest



Cateto Orange



Cherokee white



Hickory King



Bloody Butcher



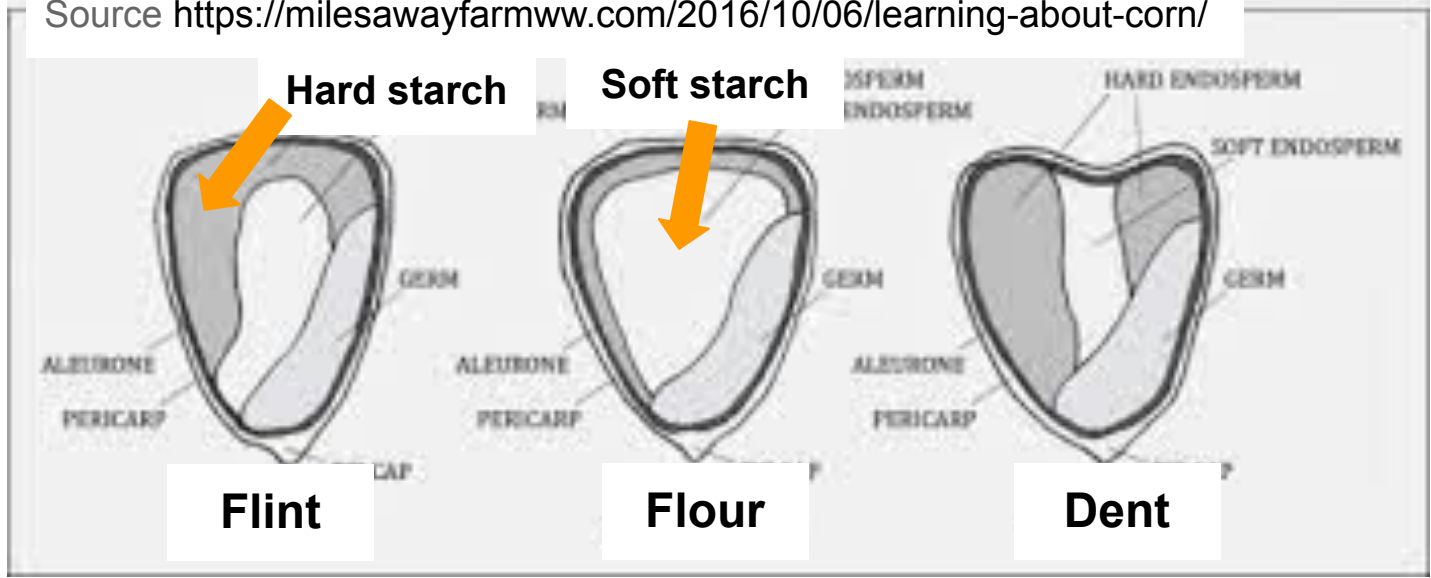
Types

Agronomy

Planting

Cultivation

Harvest



Polenta



Corn tortillas



Cornbread



Grits



Popcorn



Types

Agronomy

Planting

Cultivation

Harvest



- Indigenous dent corns from Virginia and Appalachia
- Reported yields of 150 bushels / acre before WWII (compared to ~35 bu / ac)
- Superior flour & masa qualities
- BUT flat seeds don't work well with modern planters

Sources Southern Exposure Seed Exchange, Monticello, I. Herzmark



Types

Agronomy

Planting

Cultivation

Harvest

- Corn is a heavy feeder
- Planting into a crimped rye-clover cover crop reduces N fertilizer inputs
- Has to compete with summer annuals...
- ...so needs prompt cultivation through 3-4 weeks post-emergence

Sources Valley Conservation Council

Cover cropping for corn

Winter rye &
crimson clover

Sources A. Cooper

Roller-crimper





www.4thesoil.org

Source: A Cooper



Cover crop



Minimize tillage



Cover crop



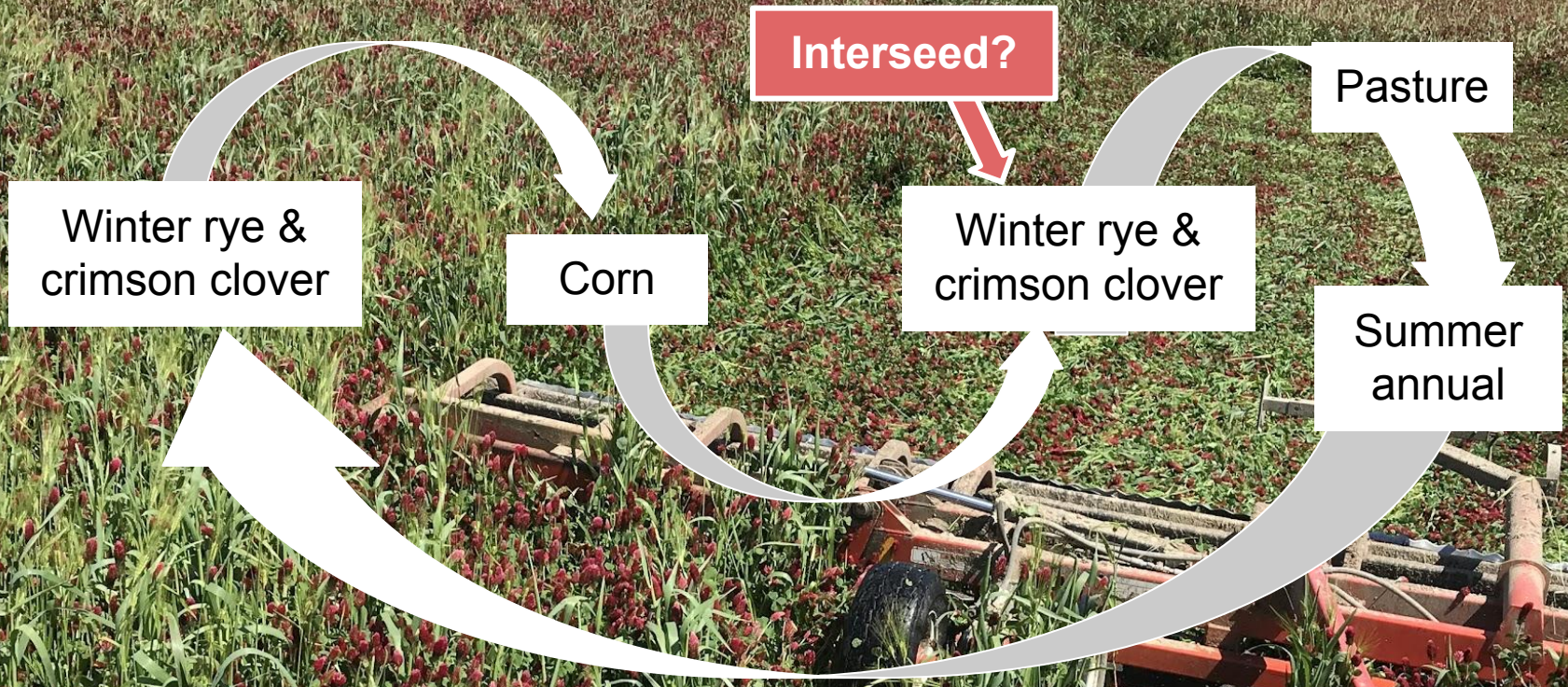
Vary crops & interseed

One-year rotation

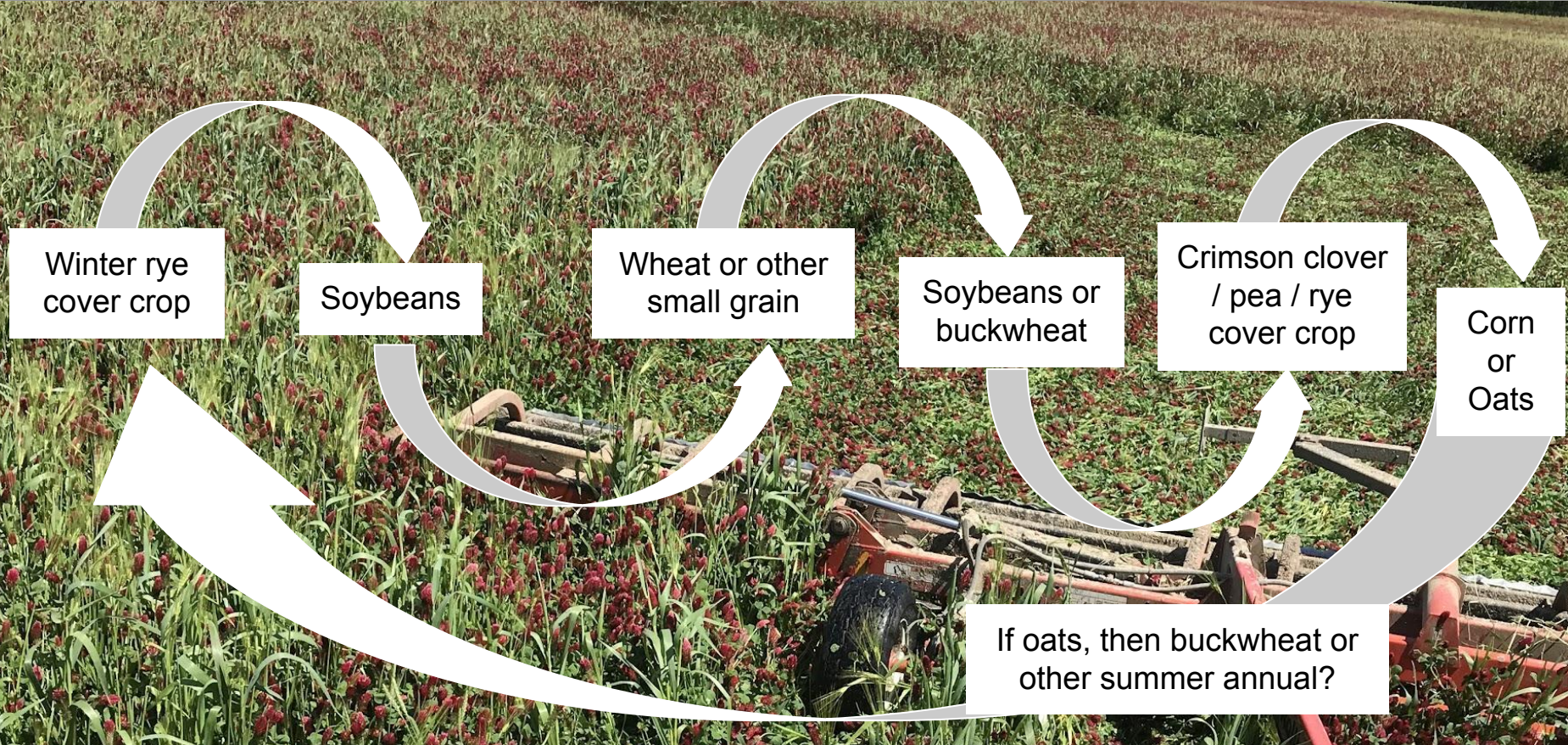


Sources A. Cooper

Two-year rotation



Three-year rotation





Timing

Soils > 50°F
As early as mid-April (BUT...)
Mid-May allows cover crop to mature

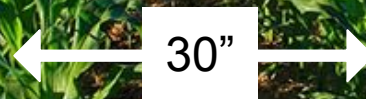
Seeding rate

800 seeds per
per 1000 sq ft
(5-9 oz)



25,000-35,000
seeds per acre
(14-24#)

Spacing



6-8" within rows

Types

Agronomy

Planting

Cultivation

Harvest

Cultivating corn





Cultivate early



Corn competes poorly with weedy summer annuals

- Flame weed, tine weed, or rotary hoe in the first 10 days after emergence

Types

Agronomy

Planting

Cultivation

Harvest



Cultivate often in the first month

Types

Agronomy

Planting

Cultivation

Harvest



- Buffalo hi-residue cultivator
- Can be used in no-till systems



Sources A. Cooper

Harvest





Small scale

- Walk row and husk as you go, or cut while green and shock
- Dry ears in covered greenhouse or shed
- Store as ears or shelled (by hand)



Types

Agronomy

Planting

Cultivation

Harvest



Mid scale

- Harvest as ears (no drying costs!)
- Harvest shelled (good to have some way to dry)
- PTO-driven picker-sheller
- **Antique equipment may be set up for 36-40" rows**



Types

Agronomy

Planting

Cultivation

Harvest



Plant corn after an N-fixing cover crop

Cultivate early & often

Ask your neighbors & extension for help

Source C Wade



Corn Questions?



Source Red Tail Grains





Wheat

Source Keenbell Farm



Types

Agronomy

Planting

Cultivation

Harvest

CLASSES OF WHEAT

Classified by color and kernel hardness, wheat is divided into six classes.



**Hard
red
winter**



**Soft
red
winter**



**Hard
red
spring**



Durum



**Hard
white**



**Soft
white**



Types

Agronomy

Planting

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CLASSES OF WHEAT

Classified by color and kernel hardness, wheat is divided into six classes



Hard red winter

Soft red winter

This block contains two illustrations of wheat stalks. The first is a taller, more robust stalk, and the second is shorter and more delicate. Below each illustration is a white box with black text. An orange arrow points from the top of the first box to the top of the second box.



- Redeemer, Nueast, Warthog, Red Fife

Hard Red Spring

Durum

Hard White

Soft White

contains perce...
tein...
an excell...
wheat will...
milling a...
charac...

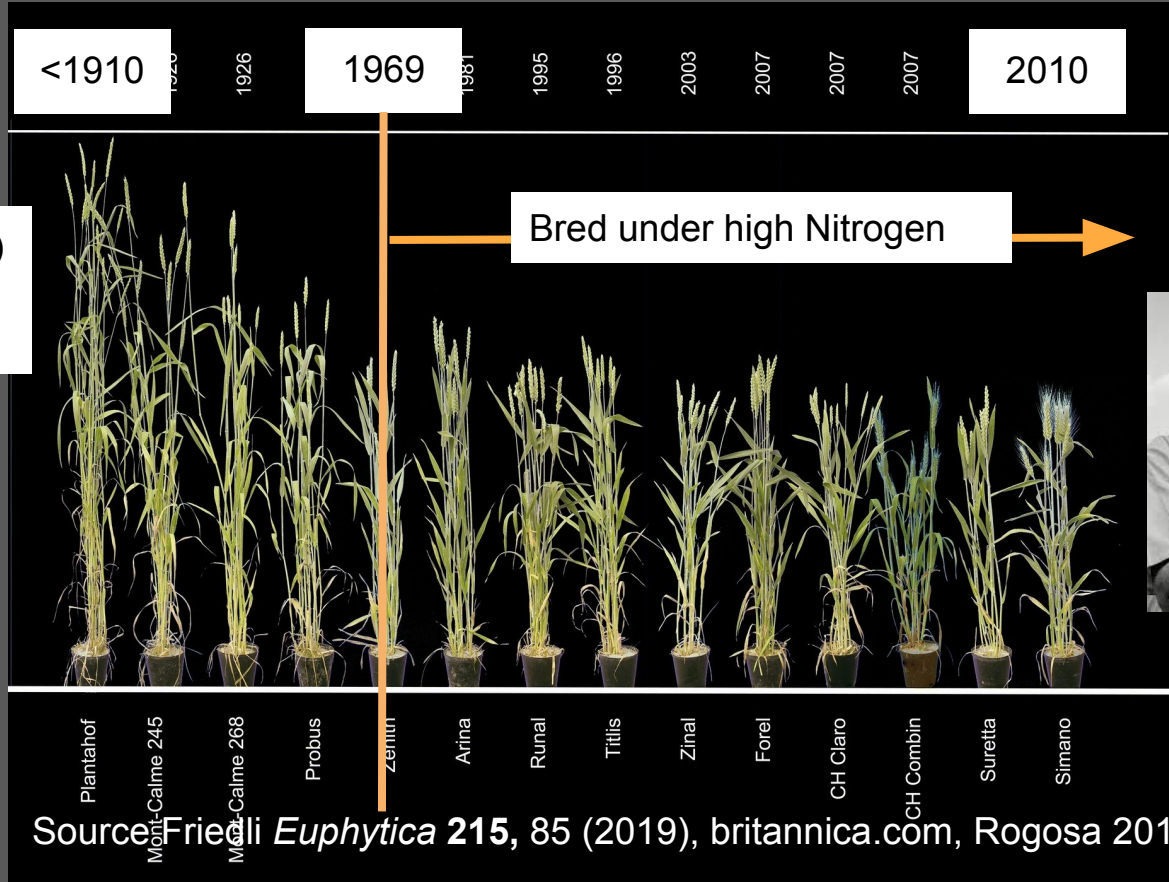
and oriental noodles.

Snack foods.

This block features a central photograph of a loaf of bread with a porous crumb. Below it are four illustrations of wheat stalks, each labeled with a class name. To the right of these labels are three smaller photographs: one showing cookies on a wooden board, one showing a basket of fried bread pieces, and one showing various pastries. A white box with a black bullet point and text is positioned above the middle two wheat stalks. An orange arrow points from the top of the 'Hard red winter' box in the previous block to the top of this white box.

“Modern wheat” = bred since 1968

Tend to lodge (fall over) when grown under high Nitrogen





Types

Agronomy

Planting

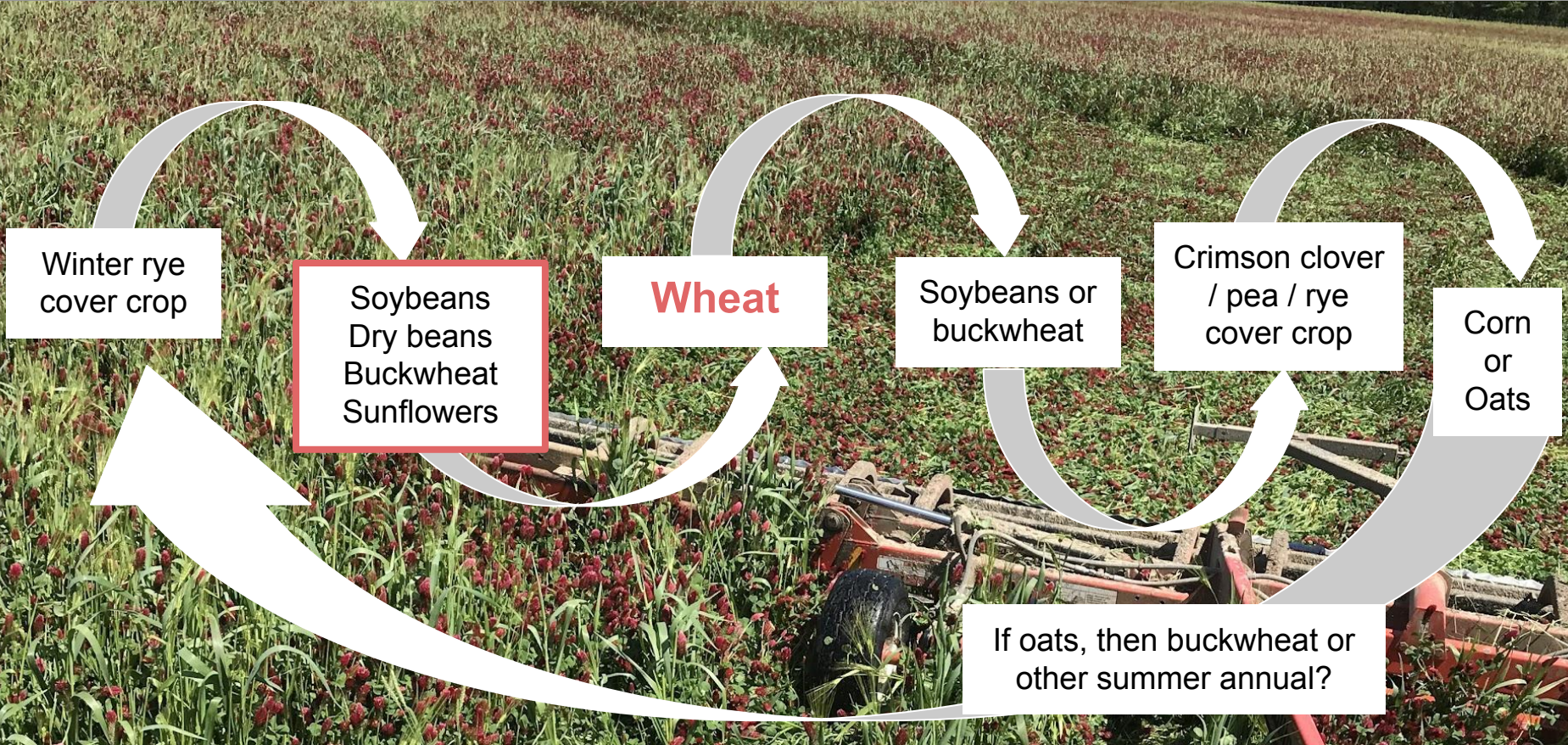
Cultivation

Harvest

- Aim for 22-25 plants / ft on 7" spacing (modern)
- Modern wheats are heavy feeders; older varieties need more space
- Don't plant into corn stover or grain stubble (*Fusarium* risk)
- Seed winter wheat in fall
- Seed spring wheat in early spring
- Good soil contact improves germination

Sources A. Cooper, Lyon (2004)

Three-year rotation



Three-year rotation

Winter
cover

Small grains enhance the whole-farm picture by

- Lengthening rotations
- Reducing compaction
- Improving nutrient cycling



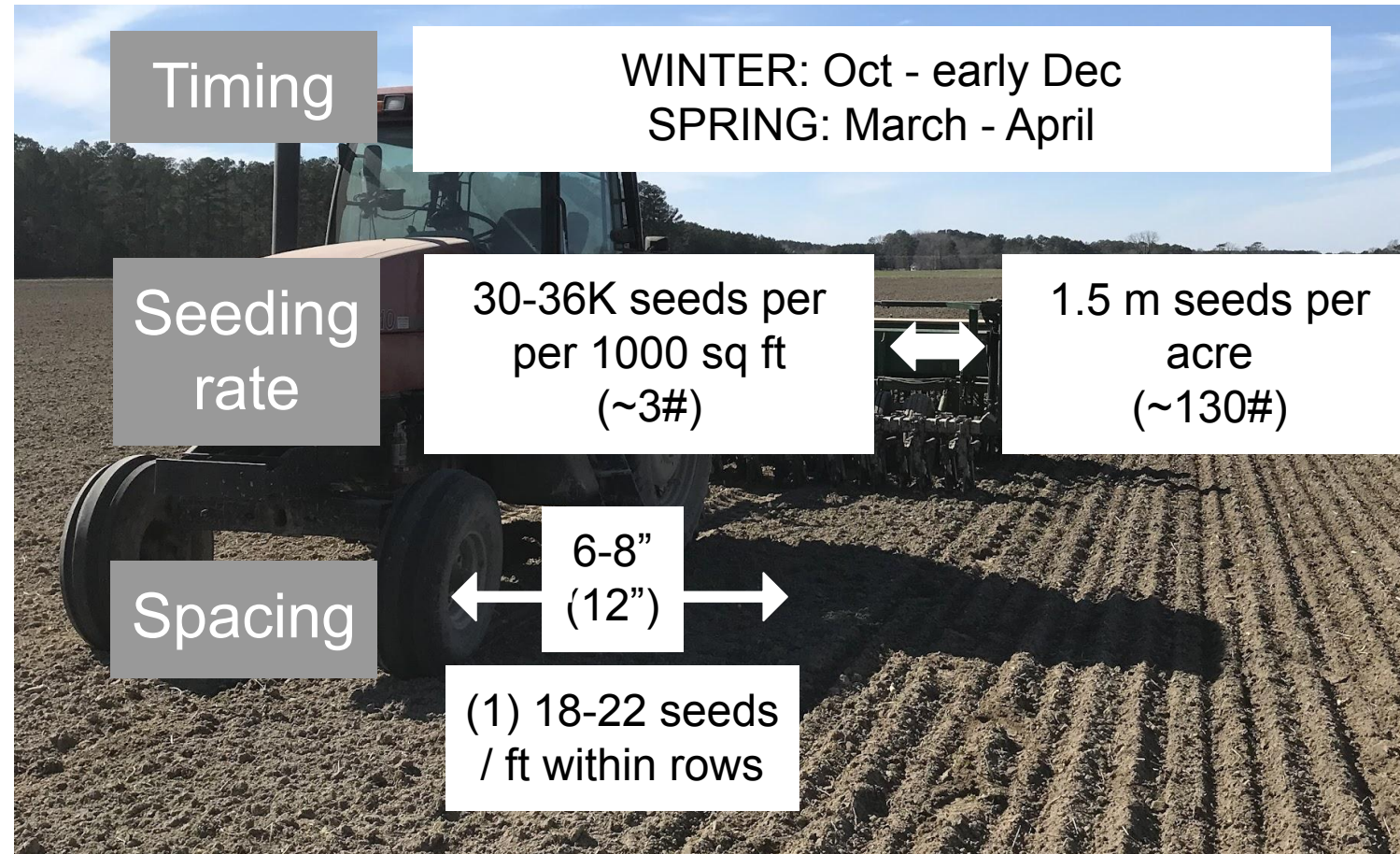
Types

Agronomy

Planting

Cultivation

Harvest



Timing

WINTER: Oct - early Dec
SPRING: March - April

Seeding rate

30-36K seeds per
per 1000 sq ft
(~3#)

1.5 m seeds per
acre
(~130#)

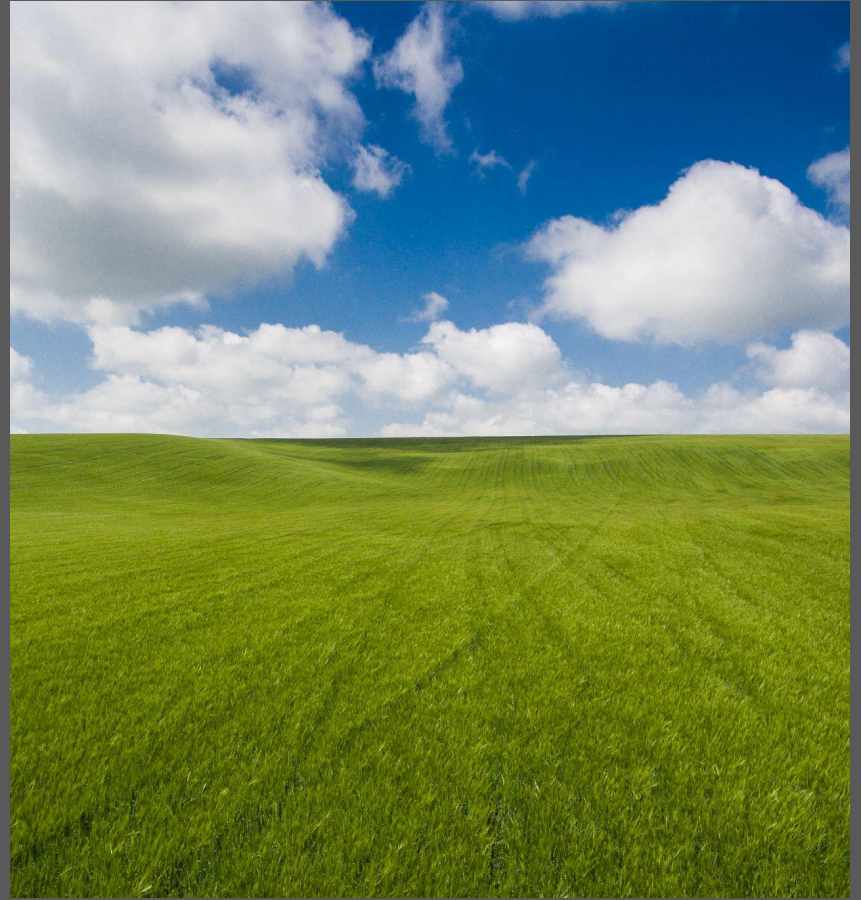
Spacing

6-8"
(12")

(1) 18-22 seeds
/ ft within rows

Sources A. Cooper, Thomason (2014), Lyon (2007)

Cultivating wheat



Source V Hanacek



Purple Mountain presents...

PurpleTools.net

GARDENER, GROWER AND GREEN LIVING SUPPLIES



6" tine weeder

- Cultivation is not strictly necessary
- Winter wheat is already green in the spring
- Spring wheat also gets a head start





Types

Agronomy

Planting

Cultivation

Harvest



Einbock Tine Weeder

Source F Sachs

Harvesting wheat



Source F Sachs



Large scale

Types

Agronomy

Planting

Cultivation

Harvest



Sources A Cooper, CJ Isbell



Large scale

Types

Agronomy

Planting

Cultivation

Harvest



\$55-70K



Sources A Cooper, CJ Isbell, Ferrari



Garden scale

Reap & Bind



Shock



Thresh



Winnow



Sources fromscratchhub, groworganic, dreamstime, ecosnippets

Types

Agronomy

Planting

Cultivation

Harvest



Small- mid-scale equipment

Reap & Bind



Shock



Thresh



Winnow



Sources Adaptive Ag, Agriexpo.online, alibaba

Types

Agronomy

Planting

Cultivation

Harvest

A wide-angle photograph of a vast, golden wheat field stretching towards a line of green trees under a bright, slightly hazy sky. The sun is low on the horizon, creating a lens flare effect. The foreground shows the texture of the wheat stalks.

Wheat enhances the whole farm

Plant following beans or other non-grain

Ask your neighbors & extension for help

A wide-angle photograph of a golden wheat field. The sun is low on the horizon, creating a bright sunburst effect with rays of light. The sky is blue with scattered white clouds. In the background, there is a dense line of green trees. The foreground shows a close-up of the wheat stalks, which are ripe and golden. A grey rectangular box is overlaid in the center of the image, containing the text "Questions?".

Questions?

Source F Sachs

Sorghum



Source Kings Agriseeds





Types

Agronomy

Planting

Cultivation

Harvest

Source Aces.edu,
sorghumcheckoff.com, science direct





- Grow like corn
- Fertilize like corn
- Drought tolerant
- Can follow wheat, barley, potatoes
- Avoid following corn
- 90-120 days to maturity
- Feed, food (GF!), biofuel

Source Aces.edu, Farm Progress, sorghumcheckoff.com, science direct

Types

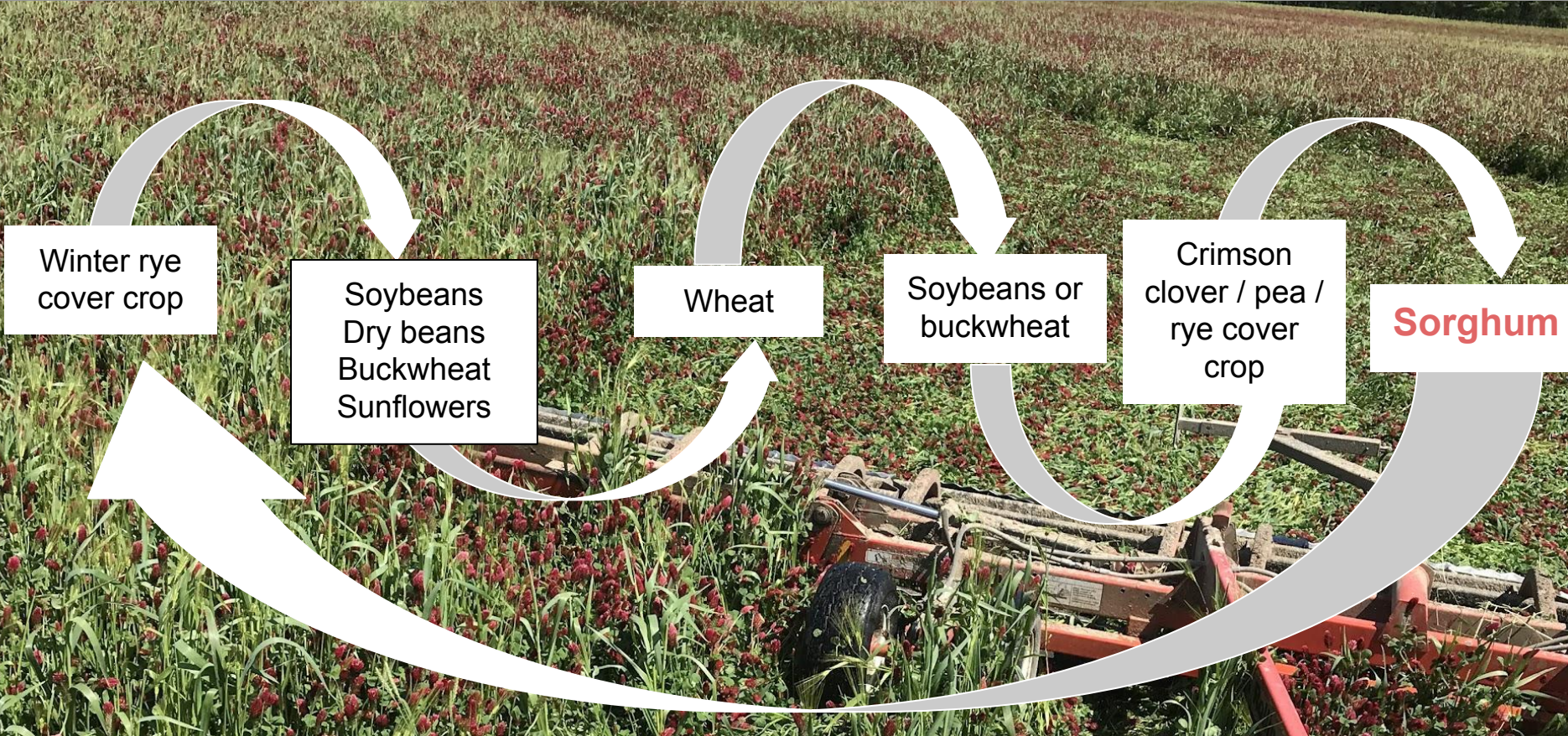
Agronomy

Planting

Cultivation

Harvest

Three-year rotation



Sources A. Cooper, T.W. Wood & Sons & Henry G. Gilbert, 1899, Logsdon, 2009



Types

Agronomy

Planting

Cultivation

Harvest

Timing

Soils > 60°F
(May 1) May 10-Jul 1 (Jul 10)

Seeding
rate

2700 seeds per
per 1000 sq ft
(3-4 oz)

115K-120K seeds
per acre
(~10#)

Spacing

(7") 15-30" (40")

3-7 seeds / ft
within rows

Sources sorghumcheckoff, Kingagri seeds



Like corn, cultivate often in the first month



Types

Agronomy

Planting

Cultivation

Harvest

Sources MS crop situation



Some harvest tips

Types

Agronomy

Planting

Cultivation

Harvest

- Birds love it, so harvest at 20-25% moisture and then dry to 12%
- Wetter grain = more trash, shattering, more drying costs
- Combining is tricky
- Harvest as little stalk as possible



Some drying tips

Types

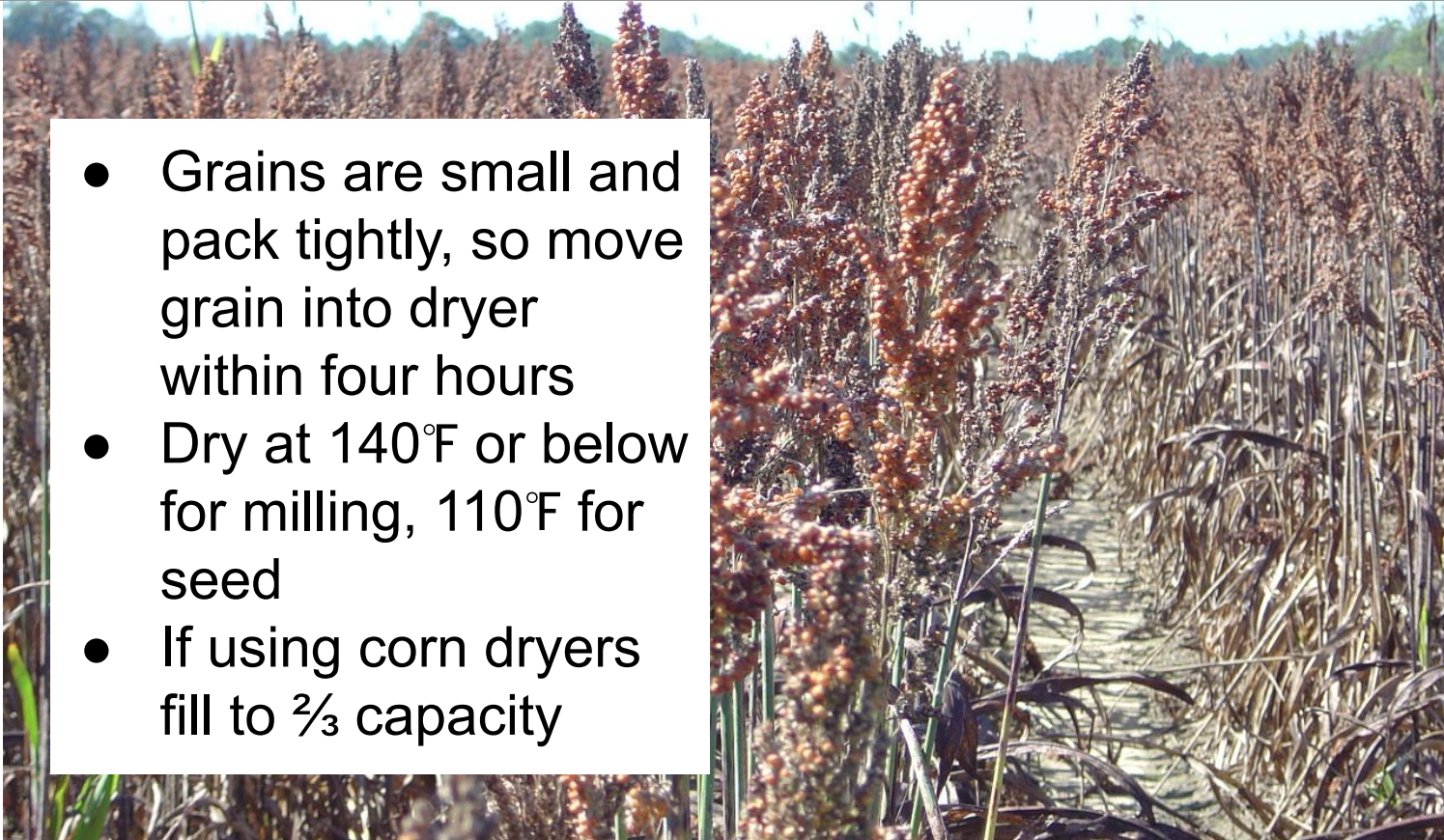
Agronomy

Planting

Cultivation

Harvest

- Grains are small and pack tightly, so move grain into dryer within four hours
- Dry at 140°F or below for milling, 110°F for seed
- If using corn dryers fill to $\frac{2}{3}$ capacity





Oats



Source morningchores





Types

Agronomy

Planting

Cultivation

Harvest



"Hullless"
Avena nuda

Don't need to dehull. "Streaker" is a good variety



"Forage"
Avena sativa



Red vs. white?

"Common"
Avena sativa

Better yields than hullless but need to be dehulled

Good for cover crops & forage but not grain



Types

Agronomy

Planting

Cultivation

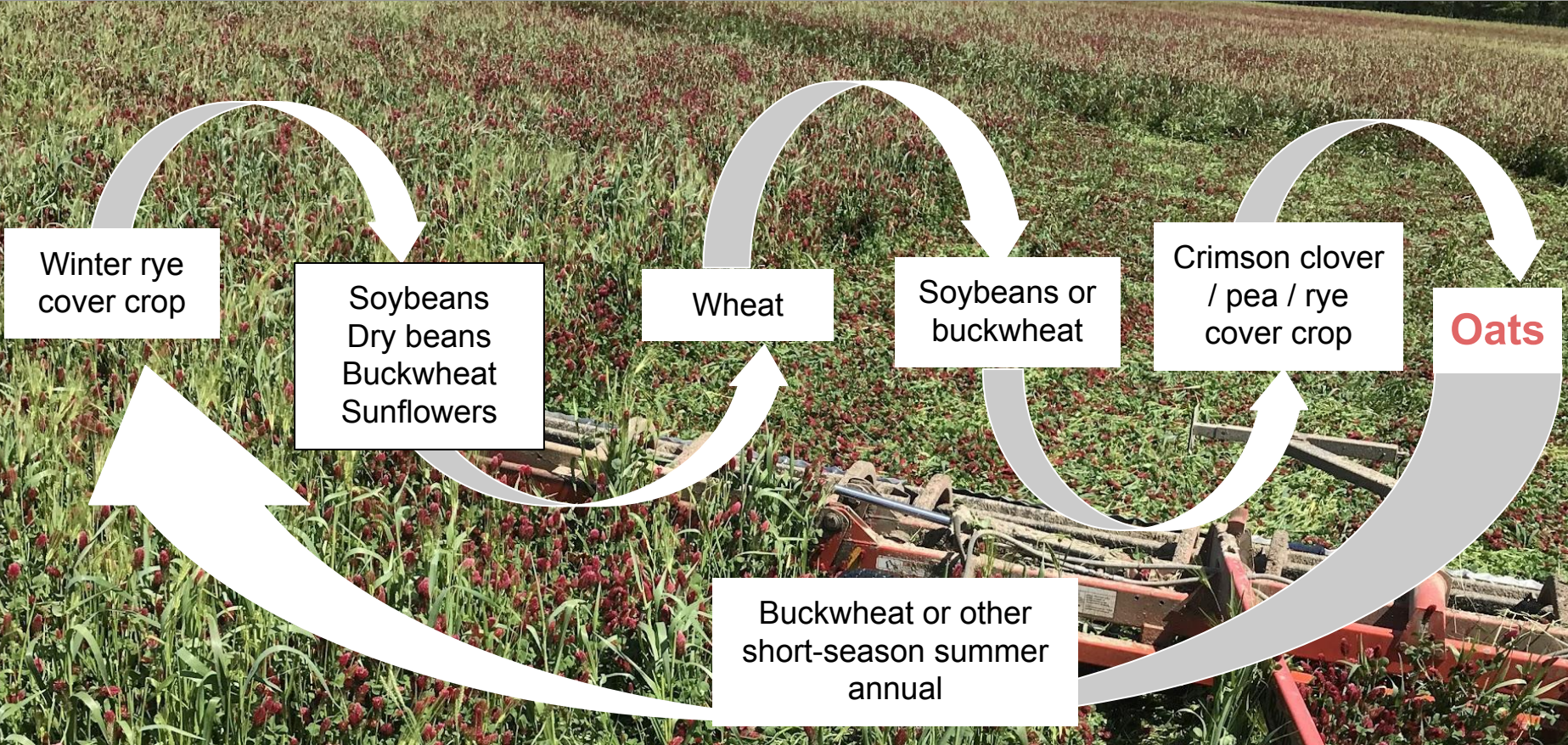
Harvest



- Grow like wheat
- Cultivate like wheat
- BUT not as heavy a feeder: too much N will cause lodging
- Avoid following grasses like corn or wheat
- 100-120 days to maturity
- If spring planted, prep ground in the fall

Source science direct, amkhaseed

Three-year rotation



Sources A. Cooper, T.W. Wood & Sons & Henry G. Gilbert, 1899, Logsdon, 2009



Types

Agronomy

Planting

Cultivation

Harvest

Timing

SPRING: As early as possible
FALL: 6-10 wks before frost, but may winter kill

Seeding rate

25000 seeds per
per 1000 sq ft
(1.5-2#)

112K seeds per
acre
(60-90#)

Spacing

7"

8-10 seeds / ft
within rows



Some harvest tips

Types

Agronomy

Planting

Cultivation

Harvest

- Harvest and thresh like wheat
- Can winnow hullless oats in water and let air dry
- Can feed unthreshed to livestock



Sources Johnny's

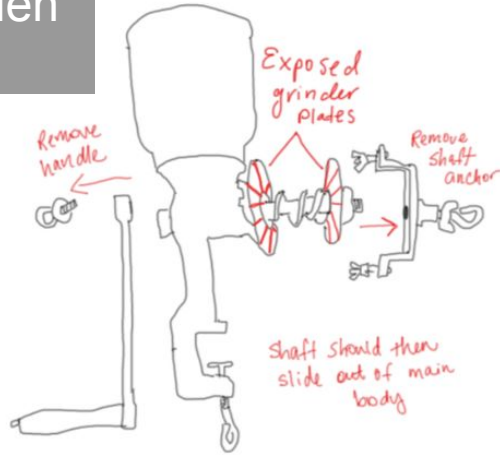
Dehulling

Applies to most oats, barley, buckwheat, rice, emmer, spelt, einkorn



Dehulling

Garden



Small-Mid

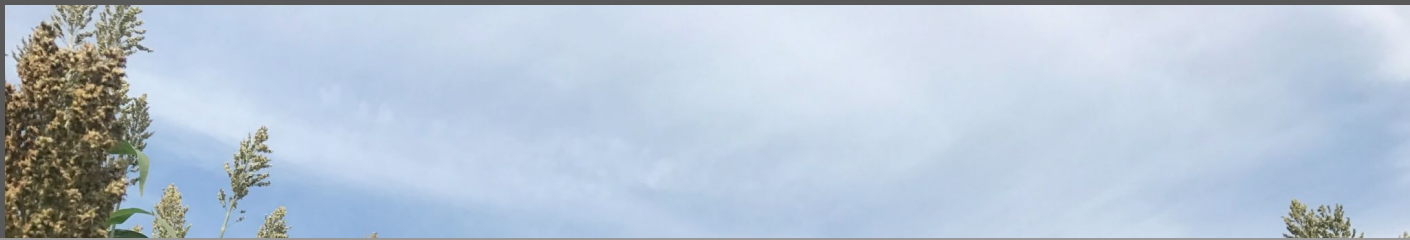


Large



Build your own, or buy a farmer-built "Trumpet". See final report for SARE grant LNE17-357





Sorghum is like corn, but harder to dry



Oats are like wheat, but fill the spring niche



Figuring out dehulling opens up a lot of crops



Source sciencedirect





Thank you!

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National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE



Source F Sachs

Discussion

**Small
Groups
(30 min)**

1. Which crop is a good choice for my farm plan or existing operation?
2. What is the appropriate scale for me?
3. How much is it going to cost?
4. Something else?

**Full Group (20 min)
&
Evaluation**



Equipment & Supplies

Grain pro (DC) – storage bags, solar dryers (202) 921-6700

<https://www.grainpro.com/en>

Purple Tools (MD) – hand tools, small grain processing equipment (301) 891-2488

<https://www.purpletools.net>

Adaptive Ag (ME) – equipment for small- and mid-size plots (207) 214-0620

<https://www.adaptive.ag/>

Your neighbors, the local farm auction, extension office

Testing

The UVM Cereal Quality Testing Lab (VT) (802) 656-5392

www.uvm.edu/extension/nwcrops/cereal-grain-testing-lab

Hartwick College Center for Craft Food and Beverage (NY) (607) 431-4232

<https://www.hartwick.edu/about-us/center-for-craft-food-and-beverage/>

JLA Labs (for corn–GA) (229) 405-6744 <https://www.jlaglobal.com/>

Seed

Albert Lea Seed (MN) (800) 352-5247 <https://alseed.com/>

Lakeview Organic (NY) (315) 531-1038 <https://lakevieworganicgrain.com/>

Fedco (ME) (207) 426-9900 <https://www.fedcoseeds.com>

NC Foundation Seed Farm (919) 269-5592 <http://www.ncfoundationseeds.org/>

**Keep
learning**

Follow our new “Growing Grain” blog at
<https://www.commongrainalliance.org/growing-grain>



Maintain air flow during storage

Fan purpose

Airflow recommendations

Natural-air drying of
grains and oilseeds

0.75 to 1.5 cfm/bu

Aeration of stored
grains and oilseeds

0.05 to 0.5 cfm/bu

